



SEQUENCE LISTING

<110> Galdes, Alphonse
Mahanthappa, Nagesh

<120> METHODS AND COMPOSITIONS FOR TREATING OR PREVENTING
PERIPHERAL NEUROPATHIES

<130> CIBT-P02-052

<140> 09/435,733
<141> 1999-11-08

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<170> PatentIn Ver. 2.0

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Cys Ala Leu Leu Val Ser Ser Gly Leu Thr Cys Gly Pro Gly Arg Gly
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Ile Gly Lys Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys
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Gln Phe Ile Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg
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Tyr Glu Gly Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr
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Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly
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gac cgc gtg ctg gct gac gcg gac ggc cgg ctg ctc tac agt gac Asp Arg Val Leu Ala Ala Asp Ala Asp Gly Arg Leu Leu Tyr Ser Asp 225	230	235	720
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gtg ccc agt atg ccc gag cgg acc ctg ggc gcg agt ggg cca gcg gag Val Pro Ser Met Pro Glu Arg Thr Leu Gly Ala Ser Gly Pro Ala Glu	50 55 60	192
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145	150	155	160
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245	250	255	
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260	265	270	
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275	280	285	
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290	295	300	
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305	310	315	320
gcc' gtg ggc gtg ttc gca ccg ctc act gcg cac ggg acg ctg ctg gtc Ala Val Gly Val Phe Ala Pro Leu Thr Ala His Gly Thr Leu Leu Val			1008
325	330	335	

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Asn Asp Val Leu Ala Ser Cys Tyr Ala Val Leu Glu Ser His Gln Trp
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Ala His Arg Ala Phe Ala Pro Leu Arg Leu Leu His Ala Leu Gly Ala
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Leu Leu Leu Leu Val Pro Ala Ala Arg Gly Cys Gly Pro Gly Arg
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Val Val Gly Ser Arg Arg Pro Pro Arg Lys Leu Val Pro Leu Ala
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Gly Arg Tyr Glu Gly Lys Ile Ala Arg Ser Ser Glu Arg Phe Lys Glu
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ctc acc ccc aac tac aat ccc gac atc atc ttc aag gac gag gag aac 288
Leu Thr Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn
85 90 95

acg ggt gcc gac cgc ctc atg acc cag cgc tgc aag gac cgt ctg aac 336
Thr Gly Ala Asp Arg Leu Met Thr Gln Arg Cys Lys Asp Arg Leu Asn
100 105 110

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Ser Leu Ala Ile Ser Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg

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cca gga gac cgg gtg ctg gcc atg ggg gag gat ggg acc ccc acc ttc Pro Gly Asp Arg Val Leu Ala Met Gly Glu Asp Gly Thr Pro Thr Phe 225	230	235	720
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cac tt ^c cgg gcc aca tt ^t gc ^g agc cat gtg caa cca ggc caa tat gtg His Phe Arg Ala Thr Phe Ala Ser His Val Gln Pro Gly Gln Tyr Val 290	295	300	912
ctg gta tca ggg gta cca gc ^g ctc cag cct gct cgg gtg gca gct gtc Leu Val Ser Gly Val Pro Gly Leu Gln Pro Ala Arg Val Ala Ala Val 305	310	315	960
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gac cac cat ctg gct cag ttg gcc ttc tgg ccc ctg cga ctg ttt ccc Asp His His Leu Ala Gln Leu Ala Phe Trp Pro Leu Arg Leu Phe Pro	355	360	365	1104
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cct cag atg ctc tac cgc ctg ggg cgt ctc ttg cta gaa gag agc acc Pro Gln Met Leu Tyr Arg Leu Gly Arg Leu Leu Glu Glu Ser Thr	385	390	395	1200
ttc cat cca ctg ggc atg tct ggg gca gga agc tgaaggact ctaaccactg Phe His Pro Leu Gly Met Ser Gly Ala Gly Ser	405	410		1253
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att ccc aac gta gcc gag aag acc cta ggg gcc agc ggc aga tat gaa Ile Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg Tyr Glu	50	55	60	192
ggg aag atc aca aga aac tcc gaa cga ttt aag gaa ctc acc ccc aat Gly Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr Pro Asn	65	70	75	80
				240
tac aac ccc gac atc ata ttt aag gat gag gaa aac acg gga gca gac Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly Ala Asp	85	90	95	288
cg ^g ctg atg act cag agg tgc aaa gac aag tta aat gcc ttg gcc atc Arg Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ala Leu Ala Ile	100	105	110	336

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 Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr Pro Asn Tyr
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Ala His Leu Ala Phe Ala Pro Ala Arg Leu Tyr Tyr Val Ser Ser			
355	360	365	
ttc ctg tcc ccc aaa act cca gca gtc ggt cca atg cga ctt tac aac			1152
Phe Leu Ser Pro Lys Thr Pro Ala Val Gly Pro Met Arg Leu Tyr Asn			
370	375	380	
agg agg ggg tcc act ggt act cca ggc tcc tgt cat caa atg gga acg			1200
Arg Arg Gly Ser Thr Gly Thr Pro Gly Ser Cys His Gln Met Gly Thr			
385	390	395	400
tgg ctt ttg gac agc aac atg ctt cat cct ttg ggg atg tca gta aac			1248
Trp Leu Leu Asp Ser Asn Met Leu His Pro Leu Gly Met Ser Val Asn			
405	410	415	
tca agc tg			1256
Ser Ser			
<210> 6			
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<221> CDS			
<222> (1)..(1425)			
<220>			
<223> "nnn" encoding "Xaa" at position 1387-1389 may be a, t, c,			
g, other or unknown			
<400> 6			
atg ctg ctg ctg gcg aga tgt ctg ctg cta gtc ctc gtc tcc tcg ctg			48
Met Leu Leu Leu Ala Arg Cys Leu Leu Leu Val Leu Val Ser Ser Leu			
1	5	10	15
ctg gta tgc tcg gga ctg gcg tgc gga ccg ggc agg ggg ttc ggg aag			96
Leu Val Cys Ser Gly Leu Ala Cys Gly Pro Gly Arg Gly Phe Gly Lys			
20	25	30	
agg agg cac ccc aaa aag ctg acc cct tta gcc tac aag cag ttt atc			144
Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys Gln Phe Ile			
35	40	45	

ccc aat gtg gcc gag aag acc cta ggc gcc agc gga agg tat gaa ggg Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg Tyr Glu Gly	50	55	60	192	
aag atc tcc aga aac tcc gag cga ttt aag gaa ctc acc ccc aat tac Lys Ile Ser Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr Pro Asn Tyr	65	70	75	80	240
aac ccc gac atc ata ttt aag gat gaa gaa aac acc gga gcg gac agg Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly Ala Asp Arg	85	90	95		288
ctg atg act cag agg tgt aag gac aag ttg aac gct ttg gcc atc tcg Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ala Leu Ala Ile Ser	100	105	110		336
gtg atg aac cag tgg cca gga gtg aaa ctg cgg gtg acc gag ggc tgg Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg Val Thr Glu Gly Trp	115	120	125		384
gac gaa gat ggc cac cac tca gag gag tct ctg cac tac gag ggc cgc Asp Glu Asp Gly His His Ser Glu Glu Ser Leu His Tyr Glu Gly Arg	130	135	140		432
gca gtg gac atc acc acg tct gac cgc gac cgc agc aag tac ggc atg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg Ser Lys Tyr Gly Met	145	150	155	160	480
ctg gcc cgc ctg gcg gtg gag gcc ggc ttc gac tgg gtg tac tac gag Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr Glu	165	170	175		528
tcc aag gca cat atc cac tgc tcg gtg aaa gca gag aac tcg gtg gcg Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn Ser Val Ala	180	185	190		576
gcc aaa tcg gga ggc tgc ttc ccg ggc tcg gcc acg gtg cac ctg gag Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Ala Thr Val His Leu Glu	195	200	205		624
cag ggc ggc acc aag ctg gtg aag gac ctg agc ccc ggg gac cgc gtg Gln Gly Gly Thr Lys Leu Val Lys Asp Leu Ser Pro Gly Asp Arg Val	210	215	220		672
ctg gcg gac gac cag ggc cgg ctg ctc tac agc gac ttc ctc act Leu Ala Ala Asp Asp Gln Gly Arg Leu Leu Tyr Ser Asp Phe Leu Thr	225	230	235	240	720
ttc ctg gac cgc gac ggc gcc aag aag gtc ttc tac gtg atc gag Phe Leu Asp Arg Asp Gly Ala Lys Lys Val Phe Tyr Val Ile Glu	245	250	255		768
acg cgg gag ccg cgc gag cgc ctg ctg acc gcc gcg cac ctg ctc Thr Arg Glu Pro Arg Glu Arg Leu Leu Leu Thr Ala Ala His Leu Leu	260	265	270		816
ttt gtg gcg ccg cac aac gac tcg gcc acc ggg gag ccc gag gcg tcc					864

Phe Val Ala Pro His Asn Asp Ser Ala Thr Gly Glu Pro Glu Ala Ser			
275	280	285	
tcg ggc tcg ggg ccg cct tcc ggg ggc gca ctg ggg cct cg ^g gcg ctg			912
Ser Gly Ser Gly Pro Pro Ser Gly Gly Ala Leu Gly Pro Arg Ala Leu			
290	295	300	
ttc gcc agc cgc gtg cgc ccg ggc cag cgc gtg tac gtg gtg gcc gag			960
Phe Ala Ser Arg Val Arg Pro Gly Gln Arg Val Tyr Val Val Ala Glu			
305	310	315	320
cgt gac ggg gac cgc ccg ctc ctg ccc gcc gct gtg cac agc gtg acc			1008
Arg Asp Gly Asp Arg Arg Leu Leu Pro Ala Ala Val His Ser Val Thr			
325	330	335	
cta agc gag gag gcc gcg ggc gcc tac gcg ccg ctc acg gcc cag ggc			1056
Leu Ser Glu Glu Ala Ala Gly Ala Tyr Ala Pro Leu Thr Ala Gln Gly			
340	345	350	
acc att ctc atc aac ccg gtg ctg gcc tcg tgc tac gcg gtc atc gag			1104
Thr Ile Leu Ile Asn Arg Val Leu Ala Ser Cys Tyr Ala Val Ile Glu			
355	360	365	
gag cac agc tgg gcg cac ccg gcc ttc gcg ccc ttc cgc ctg gcg cac			1152
Glu His Ser Trp Ala His Arg Ala Phe Ala Pro Phe Arg Leu Ala His			
370	375	380	
gcg ctc ctg gct gca ctg gcg ccc gcg cgc acg gac cgc ggc ggg gac			1200
Ala Leu Leu Ala Ala Leu Ala Pro Ala Arg Thr Asp Arg Gly Gly Asp			
385	390	395	400
agc ggc ggc ggg gac cgc ggg ggc ggc ggc aga gta gcc cta acc			1248
Ser Gly Gly Asp Arg Gly Gly Gly Arg Val Ala Leu Thr			
405	410	415	
gct cca ggt gct gcc gac gct ccg ggt gcg ggg gcc acc gcg ggc atc			1296
Ala Pro Gly Ala Ala Asp Ala Pro Gly Ala Gly Ala Thr Ala Gly Ile			
420	425	430	
cac tgg tac tcg cag ctg ctc tac caa ata ggc acc tgg ctc ctg gac			1344
His Trp Tyr Ser Gln Leu Leu Tyr Gln Ile Gly Thr Trp Leu Leu Asp			
435	440	445	
agc gag gcc ctg cac ccg ctg ggc atg gcg gtc aag tcc agc nnn agc			1392
Ser Glu Ala Leu His Pro Leu Gly Met Ala Val Lys Ser Ser Xaa Ser			
450	455	460	
cg ^g ggg gcc ggg gga ggg gcg ccg gag ggg gcc			1425
Arg Gly Ala Gly Gly Ala Arg Glu Gly Ala			
465	470	475	
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<211> 1622			
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<222> (51)..(1283)

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Met Ser
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ccc gcc cgg ctc cg⁵ ccc cga ctg cac ttc tgc ctg gtc ctg ttg ctg 104
Pro Ala Arg Leu Arg Pro Arg Leu His Phe Cys Leu Val Leu Leu Leu
10 15

ctg ctg gtg gtg ccc gcg gca tgg ggc tgc ggg ccg ggt cgg gtg gtg 152
Leu Leu Val Val Pro Ala Ala Trp Gly Cys Gly Pro Gly Arg Val Val
20 25 30

ggc agc cgc cgg cga cc³⁵ cca cgc aaa ctc gtg ccg ctc gcc tac aag 200
Gly Ser Arg Arg Pro Pro Arg Lys Leu Val Pro Leu Ala Tyr Lys
40 45 50

cag ttc agc ccc aat gtg ccc gag aag acc ctg ggc gcc agc gga cgc 248
Gln Phe Ser Pro Asn Val Pro Glu Lys Thr Leu Gly Ala Ser Gly Arg
55 60 65

tat gaa ggc aag atc gct cgc agc tcc gag cgc ttc aag gag ctc acc 296
Tyr Glu Gly Lys Ile Ala Arg Ser Ser Glu Arg Phe Lys Glu Leu Thr
70 75 80

ccc aat tac aat cca gac atc atc ttc aag gac gag gag aac aca ggc 344
Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly
85 90 95

gcc gac cgc ctc atg acc cag cgc tgc aag gac cgc ctg aac tcg ctg 392
Ala Asp Arg Leu Met Thr Gln Arg Cys Lys Asp Arg Leu Asn Ser Leu
100 105 110

gct atc tcg gtg atg aac cag tgg ccc ggt gtg aag ctg cgg gtg acc 440
Ala Ile Ser Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg Val Thr
115 120 125 130

gag ggc tgg gac gag gac ggc cac cac tca gag gag tcc ctg cat tat 488
Glu Gly Trp Asp Glu Asp Gly His His Ser Glu Glu Ser Leu His Tyr
135 140 145

gag ggc cgc gcg gtg gac atc acc aca tca gac cgc gac cgc aat aag 536
Glu Gly Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg Asn Lys
150 155 160

tat gga ctg ctg gcg cgc ttg gca gtg gag gcc ggc ttt gac tgg gtg 584
Tyr Gly Leu Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val
165 170 175

tat tac gag tca aag gcc cac gtg cat tgc tcc gtc aag tcc gag cac 632
Tyr Tyr Glu Ser Lys Ala His Val His Cys Ser Val Lys Ser Glu His
180 185 190

tcg gcc gca gcc aag acg ggc ggc tgc ttc cct gcc gga gcc cag gta 680

Ser Ala Ala Ala Lys Thr Gly Gly Cys Phe Pro Ala Gly Ala Gln Val			
195	200	205	210
cgc ctg gag agt ggg gcg cgt gtg gcc ttg tca gcc gtg agg ccg gga	728		
Arg Leu Glu Ser Gly Ala Arg Val Ala Leu Ser Ala Val Arg Pro Gly			
215	220	225	
gac cgt gtg ctg gcc atg ggg gag gat ggg agc ccc acc ttc agc gat	776		
Asp Arg Val Leu Ala Met Gly Glu Asp Gly Ser Pro Thr Phe Ser Asp			
230	235	240	
gtg ctc att ttc ctg gac cgc gag ccc cac agg ctg aga gcc ttc cag	824		
Val Leu Ile Phe Leu Asp Arg Glu Pro His Arg Leu Arg Ala Phe Gln			
245	250	255	
gtc atc gag act cag gac ccc cca cgc cgc ctg gca ctc aca ccc gct	872		
Val Ile Glu Thr Gln Asp Pro Pro Arg Arg Leu Ala Leu Thr Pro Ala			
260	265	270	
cac ctg ctc ttt acg gct gac aat cac acg gag ccg gca gcc cgc ttc	920		
His Leu Leu Phe Thr Ala Asp Asn His Thr Glu Pro Ala Ala Arg Phe			
275	280	285	290
cgg gcc aca ttt gcc agc cac gtg cag cct ggc cag tac gtg ctg gtg	968		
Arg Ala Thr Phe Ala Ser His Val Gln Pro Gly Gln Tyr Val Leu Val			
295	300	305	
gct ggg gtg cca ggc ctg cag cct gcc cgc gtg gca gct gtc tct aca	1016		
Ala Gly Val Pro Gly Leu Gln Pro Ala Arg Val Ala Ala Val Ser Thr			
310	315	320	
cac gtg gcc ctc ggg gcc tac gcc ccg ctc aca aag cat ggg aca ctg	1064		
His Val Ala Leu Gly Ala Tyr Ala Pro Leu Thr Lys His Gly Thr Leu			
325	330	335	
gtg gtg gag gat gtg gtg gca tcc tgc ttc gcg gcc gtg gct gac cac	1112		
Val Val Glu Asp Val Val Ala Ser Cys Phe Ala Ala Val Ala Asp His			
340	345	350	
cac ctg gct cag ttg gcc ttc tgg ccc ctg aga ctc ttt cac agc ttg	1160		
His Leu Ala Gln Leu Ala Phe Trp Pro Leu Arg Leu Phe His Ser Leu			
355	360	365	370
gca tgg ggc agc tgg acc ccg ggg gag ggt gtg cat tgg tac ccc cag	1208		
Ala Trp Gly Ser Trp Thr Pro Gly Glu Gly Val His Trp Tyr Pro Gln			
375	380	385	
ctg ctc tac cgc ctg ggg cgt ctc ctg cta gaa gag ggc agc ttc cac	1256		
Leu Leu Tyr Arg Leu Gly Arg Leu Leu Glu Glu Gly Ser Phe His			
390	395	400	
cca ctg ggc atg tcc ggg gca ggg agc tgaaaggact ccaccgctgc	1303		
Pro Leu Gly Met Ser Gly Ala Gly Ser			
405	410		
cctcctggaa ctgctgtact gggtccagaa gcctctcagc caggagggag ctggccctgg	1363		

aaggcacctg agctggggga cactggctcc tgccatctcc tctgccatga agatacacca 1423
 ttgagacttg actgggcaac accagcgtcc cccaccccgcg tcgtggtgta gtcatalogc 1483
 tgcaagctga gctggcgagg ggatggttgt tgaccctct ctccctagaga ccttggggct 1543
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 attgggaggg cccattccc 1622

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 <211> 1190
 <212> DNA
 <213> human Dhh

 <220>
 <221> CDS
 <222> (1)..(1188)

 <400> 8
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 1 5 10 15

 gcg ctg cca gcc cag agc tgc ggg ccg ggc cgg ggg ccg gtt ggc cg 96
 Ala Leu Pro Ala Gln Ser Cys Gly Pro Gly Arg Gly Pro Val Gly Arg
 20 25 30

 cgc cgc tat gcg cgc aag cag ctc gtg ccg cta ctc tac aag caa ttt 144
 Arg Arg Tyr Ala Arg Lys Gln Leu Val Pro Leu Leu Tyr Lys Gln Phe
 35 40 45

 gtg ccc ggc gtg cca gag cgg acc ctg ggc gcc agt ggg cca gcg gag 192
 Val Pro Gly Val Pro Glu Arg Thr Leu Gly Ala Ser Gly Pro Ala Glu
 50 55 60

 ggg agg gtg gca agg ggc tcc gag cgc ttc cgg gac ctc gtg ccc aac 240
 Gly Arg Val Ala Arg Gly Ser Glu Arg Phe Arg Asp Leu Val Pro Asn
 65 70 75 80

 tac aac ccc gac atc atc ttc aag gat gag gag aac agt gga gcc gac 288
 Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Ser Gly Ala Asp
 85 90 95

 cgc ctg atg acc gag cgt tgc aag gag agg gtg aac gct ttg gcc att 336
 Arg Leu Met Thr Glu Arg Cys Lys Glu Arg Val Asn Ala Leu Ala Ile
 100 105 110

 gcc gtg atg aac atg tgg ccc gga gtg cgc cta cga gtg act gag ggc 384
 Ala Val Met Asn Met Trp Pro Gly Val Arg Leu Arg Val Thr Glu Gly
 115 120 125

 tgg gac gag gac ggc cac cac gct cag gat tca ctc cac tac gaa ggc 432
 Trp Asp Glu Asp Gly His His Ala Gln Asp Ser Leu His Tyr Glu Gly
 130 135 140

 cgt gct ttg gac atc act acg tct gac cgc gac cgc aac aag tat ggg 480

Arg	Ala	Leu	Asp	Ile	Thr	Thr	Ser	Asp	Arg	Asp	Arg	Asn	Lys	Tyr	Gly	
145				150					155				160			
ttg	ctg	gcg	cgc	ctc	gca	gtg	gaa	gcc	ggc	tac	gac	tgg	gtc	tac	tac	528
Leu	Leu	Ala	Arg	Leu	Ala	Val	Glu	Ala	Gly	Phe	Asp	Trp	Val	Tyr	Tyr	
165				170					175							
gag	tcc	cgc	aac	cac	gtc	cac	gtg	tcg	gtc	aaa	gct	gat	aac	tca	ctg	576
Glu	Ser	Arg	Asn	His	Val	His	Val	Ser	Val	Lys	Ala	Asp	Asn	Ser	Leu	
180				185					190							
gcg	gtc	cgg	gcf	ggc	ttc	ccg	gga	aat	gca	act	gtg	cgc	ctg			624
Ala	Val	Arg	Ala	Gly	Gly	Cys	Phe	Pro	Gly	Asn	Ala	Thr	Val	Arg	Leu	
195				200					205							
tgg	agc	ggc	gag	cgf	aaa	ggg	ctg	cgf	gaa	ctg	cac	cgc	gga	gac	tgg	672
Trp	Ser	Gly	Glu	Arg	Lys	Gly	Leu	Arg	Glu	Leu	His	Arg	Gly	Asp	Trp	
210				215					220							
gtt	ttg	gcg	gcc	gat	gcf	tca	ggc	cgf	gtg	ccc	acg	ccg	gtg	ctg		720
Val	Leu	Ala	Ala	Asp	Ala	Ser	Gly	Arg	Val	Val	Pro	Thr	Pro	Val	Leu	
225				230					235				240			
ctc	tcc	ctg	gac	cgf	gac	ttg	cag	cgf	cgf	gct	tca	ttt	gtg	gct	gtg	768
Leu	Phe	Leu	Asp	Arg	Asp	Leu	Gln	Arg	Ala	Ser	Phe	Val	Ala	Val		
245				250					255							
gag	acc	gag	tgg	cct	cca	cgf	aaa	ctg	ttg	ctc	acg	ccc	tgg	cac	ctg	816
Glu	Thr	Glu	Trp	Pro	Pro	Arg	Lys	Leu	Leu	Leu	Thr	Pro	Trp	His	Leu	
260				265					270							
gtg	ttt	gcc	gct	cga	ggg	ccg	gcf	ccc	gcf	cca	ggc	gac	ttt	gca	ccg	864
Val	Phe	Ala	Ala	Arg	Gly	Pro	Ala	Pro	Ala	Pro	Gly	Asp	Phe	Ala	Pro	
275				280					285							
gtg	tcc	gcg	cgc	cgf	cta	cgf	gct	ggg	gac	tcg	gtg	ctg	gcf	ccc	ggc	912
Val	Phe	Ala	Arg	Arg	Leu	Arg	Ala	Gly	Asp	Ser	Val	Leu	Ala	Pro	Gly	
290				295					300							
ggg	gat	gcf	ctt	cgf	cca	gcf	cgf	gtg	gcc	cgt	gtg	gcf	cgf	gag	gaa	960
Gly	Asp	Ala	Leu	Arg	Pro	Ala	Arg	Val	Ala	Arg	Val	Ala	Arg	Glu	Glu	
305				310					315				320			
gcc	gtg	ggc	gtg	ttc	gcf	ccg	ctc	acc	gcf	cac	ggg	acg	ctg	ctg	gtg	1008
Ala	Val	Gly	Val	Phe	Ala	Pro	Leu	Thr	Ala	His	Gly	Thr	Leu	Leu	Val	
325				330					335							
aac	gat	gtc	ctg	gcc	tct	tgc	tac	gcf	gtt	ctg	gag	agt	cac	cag	tgg	1056
Asn	Asp	Val	Leu	Ala	Ser	Cys	Tyr	Ala	Val	Leu	Glu	Ser	His	Gln	Trp	
340				345					350							
gcg	cac	cgc	gct	ttt	gcc	ccc	ttg	aga	ctg	ctg	cac	gcf	cta	ggg	gcf	1104
Ala	His	Arg	Ala	Phe	Ala	Pro	Leu	Arg	Leu	Leu	His	Ala	Leu	Gly	Ala	
355				360					365							
ctg	ctc	ccc	ggc	ggg	gcc	gtc	cag	ccg	act	ggc	atg	cat	tgg	tac	tct	1152
Leu	Leu	Pro	Gly	Gly	Ala	Val	Gln	Pro	Thr	Gly	Met	His	Trp	Tyr	Ser	

Tyr	Gly	Met	Leu	Ser	Arg	Leu	Ala	Val	Glu	Ala	Gly	Phe	Asp	Trp	Val			
																165		
																170		
																175		
tat	tat	gaa	tct	aaa	gcc	cac	ata	cac	tgc	tct	gtc	aaa	gca	gaa	aat		576	
Tyr	Tyr	Glu	Ser	Lys	Ala	His	Ile	His	Cys	Ser	Val	Lys	Ala	Glu	Asn			
																180		
																185		
tca	gtg	gct	gct	aaa	tca	gga	gga	tgt	ttt	cct	ggg	tct	ggg	acg	gtg		624	
Ser	Val	Ala	Ala	Lys	Ser	Gly	Gly	Cys	Phe	Pro	Gly	Ser	Gly	Thr	Val			
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																200		
																205		
aca	ctt	ggg	gtt	gat	ggg	acg	agg	aaa	ccc	atc	aaa	gat	ctt	aaa	gtg	ggc		672
Thr	Leu	Gly	Asp	Gly	Thr	Arg	Lys	Pro	Ile	Lys	Asp	Leu	Lys	Val	Gly			
																210		
																215		
																220		
gac	cgg	gtt	ttg	gct	gca	gac	gag	aag	gga	aat	gtc	tta	ata	agc	gac		720	
Asp	Arg	Val	Leu	Ala	Ala	Asp	Glu	Lys	Gly	Asn	Val	Leu	Ile	Ser	Asp			
																225		
																230		
																235		
																240		
ttt	att	atg	ttt	ata	gac	cac	gat	ccg	aca	acg	aga	agg	caa	ttc	atc		768	
Phe	Ile	Met	Phe	Ile	Asp	His	Asp	Pro	Thr	Thr	Arg	Arg	Gln	Phe	Ile			
																245		
																250		
																255		
gtc	atc	gag	acg	tca	gaa	cct	ttc	acc	aag	ctc	acc	ctc	act	gcc	qcg		816	
Val	Ile	Glu	Thr	Ser	Glu	Pro	Phe	Thr	Lys	Leu	Thr	Leu	Thr	Ala	Ala			
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																265		
																270		
cac	cta	gtt	ttc	gtt	gga	aac	tct	tca	gca	gct	tcg	ggt	ata	aca	gca		864	
His	Leu	Val	Phe	Val	Gly	Asn	Ser	Ser	Ala	Ala	Ser	Gly	Ile	Thr	Ala			
																275		
																280		
																285		
aca	ttt	gcc	agc	aac	gtg	aag	cct	gga	gat	aca	gtt	tta	gtg	tgg	gaa		912	
Thr	Phe	Ala	Ser	Asn	Val	Lys	Pro	Gly	Asp	Thr	Val	Leu	Val	Trp	Glu			
																290		
																295		
																300		
gac	aca	tgc	gag	agc	ctc	aag	agc	gtt	aca	gtg	aaa	agg	att	tac	act		960	
Asp	Thr	Cys	Glu	Ser	Leu	Lys	Ser	Val	Thr	Val	Lys	Arg	Ile	Tyr	Thr			
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																310		
																315		
																320		
gag	gag	cac	gag	ggc	tct	ttt	gcg	cca	gtc	acc	gcg	cac	gga	acc	ata		1008	
Glu	Glu	His	Glu	Gly	Ser	Phe	Ala	Pro	Val	Thr	Ala	His	Gly	Thr	Ile			
																325		
																330		
																335		
ata	gtg	gat	cag	gtg	ttg	gca	tgc	tgc	tac	gct	att	gag	aac	cac			1056	
Ile	Val	Asp	Gln	Val	Leu	Ala	Ser	Cys	Tyr	Ala	Val	Ile	Glu	Asn	His			
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																345		
																350		
aaa	tgg	gca	cat	tgg	gct	ttt	gcg	ccg	gtc	agg	ttg	tgt	cac	aag	ctg		1104	
Lys	Trp	Ala	His	Trp	Ala	Phe	Ala	Pro	Val	Arg	Leu	Cys	His	Lys	Leu			
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																360		
																365		
atg	acg	tgg	ctt	ttt	ccg	gct	cgt	gaa	tca	aac	gtc	aat	ttt	cag	gag		1152	
Met	Thr	Trp	Leu	Phe	Pro	Ala	Arg	Glu	Ser	Asn	Val	Asn	Phe	Gln	Glu			
																370		
																375		
																380		
gat	ggc	atc	cac	tgg	tac	tca	aat	atg	ctg	ttt	cac	atc	ggc	tct	tgg		1200	
Asp	Gly	Ile	His	Trp	Tyr	Ser	Asn	Met	Leu	Phe	His	Ile	Gly	Ser	Trp			

385 390 395 400

ctg ctg gac aga gac tct ttc cat cca ctc ggg att tta cac tta agt 1248
Leu Leu Asp Arg Asp Ser Phe His Pro Leu Gly Ile Leu His Leu Ser
405 410 415

tga 1251

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<211> 425
<212> PRT
<213> chicken Shh

<400> 10
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Cys Ala Leu Leu Val Ser Ser Gly Leu Thr Cys Gly Pro Gly Arg Gly 20 25 30

Ile Gly Lys Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys 35 40 45

Gln Phe Ile Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg 50 55 60

Tyr Glu Gly Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr 65 70 75 80

Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly 85 90 95

Ala Asp Arg Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ala Leu 100 105 110

Ala Ile Ser Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg Val Thr 115 120 125

Glu Gly Trp Asp Glu Asp Gly His His Ser Glu Glu Ser Leu His Tyr 130 135 140

Glu Gly Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg Ser Lys 145 150 155 160

Tyr Gly Met Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val 165 170 175

Tyr Tyr Glu Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn 180 185 190

Ser Val Ala Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Ala Thr Val 195 200 205

His Leu Glu His Gly Gly Thr Lys Leu Val Lys Asp Leu Ser Pro Gly 210 215 220

Asp Arg Val Leu Ala Ala Asp Ala Asp Gly Arg Leu Leu Tyr Ser Asp

225	230	235	240
Phe Leu Thr Phe Leu Asp Arg Met Asp Ser Ser Arg Lys Leu Phe Tyr			
245	250	255	
Val Ile Glu Thr Arg Gln Pro Arg Ala Arg Leu Leu Leu Thr Ala Ala			
260	265	270	
His Leu Leu Phe Val Ala Pro Gln His Asn Gln Ser Glu Ala Thr Gly			
275	280	285	
Ser Thr Ser Gly Gln Ala Leu Phe Ala Ser Asn Val Lys Pro Gly Gln			
290	295	300	
Arg Val Tyr Val Leu Gly Glu Gly Gln Gln Leu Leu Pro Ala Ser			
305	310	315	320
Val His Ser Val Ser Leu Arg Glu Glu Ala Ser Gly Ala Tyr Ala Pro			
325	330	335	
Leu Thr Ala Gln Gly Thr Ile Leu Ile Asn Arg Val Leu Ala Ser Cys			
340	345	350	
Tyr Ala Val Ile Glu Glu His Ser Trp Ala His Trp Ala Phe Ala Pro			
355	360	365	
Phe Arg Leu Ala Gln Gly Leu Leu Ala Ala Leu Cys Pro Asp Gly Ala			
370	375	380	
Ile Pro Thr Ala Ala Thr Thr Thr Gly Ile His Trp Tyr Ser Arg			
385	390	395	400
Leu Leu Tyr Arg Ile Gly Ser Trp Val Leu Asp Gly Asp Ala Leu His			
405	410	415	
Pro Leu Gly Met Val Ala Pro Ala Ser			
420	425		
<210> 11			
<211> 396			
<212> PRT			
<213> mouse Dhh			
<400> 11			
Met Ala Leu Pro Ala Ser Leu Leu Pro Leu Cys Cys Leu Ala Leu Leu			
1	5	10	15
Ala Leu Ser Ala Gln Ser Cys Gly Pro Gly Arg Gly Pro Val Gly Arg			
20	25	30	
Arg Arg Tyr Val Arg Lys Gln Leu Val Pro Leu Leu Tyr Lys Gln Phe			
35	40	45	
Val Pro Ser Met Pro Glu Arg Thr Leu Gly Ala Ser Gly Pro Ala Glu			
50	55	60	
Gly Arg Val Thr Arg Gly Ser Glu Arg Phe Arg Asp Leu Val Pro Asn			

65	70	75	80
Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Ser Gly Ala Asp			
85	90	95	
Arg Leu Met Thr Glu Arg Cys Lys Glu Arg Val Asn Ala Leu Ala Ile			
100	105	110	
Ala Val Met Asn Met Trp Pro Gly Val Arg Leu Arg Val Thr Glu Gly			
115	120	125	
Trp Asp Glu Asp Gly His His Ala Gln Asp Ser Leu His Tyr Glu Gly			
130	135	140	
Arg Ala Leu Asp Ile Thr Thr Ser Asp Arg Asp Arg Asn Lys Tyr Gly			
145	150	155	160
Leu Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr			
165	170	175	
Glu Ser Arg Asn His Ile His Val Ser Val Lys Ala Asp Asn Ser Leu			
180	185	190	
Ala Val Arg Ala Gly Gly Cys Phe Pro Gly Asn Ala Thr Val Arg Leu			
195	200	205	
Arg Ser Gly Glu Arg Lys Gly Leu Arg Glu Leu His Arg Gly Asp Trp			
210	215	220	
Val Leu Ala Ala Asp Ala Ala Gly Arg Val Val Pro Thr Pro Val Leu			
225	230	235	240
Leu Phe Leu Asp Arg Asp Leu Gln Arg Arg Ala Ser Phe Val Ala Val			
245	250	255	
Glu Thr Glu Arg Pro Pro Arg Lys Leu Leu Leu Thr Pro Trp His Leu			
260	265	270	
Val Phe Ala Ala Arg Gly Pro Ala Pro Ala Pro Gly Asp Phe Ala Pro			
275	280	285	
Val Phe Ala Arg Arg Leu Arg Ala Gly Asp Ser Val Leu Ala Pro Gly			
290	295	300	
Gly Asp Ala Leu Gln Pro Ala Arg Val Ala Arg Val Ala Arg Glu Glu			
305	310	315	320
Ala Val Gly Val Phe Ala Pro Leu Thr Ala His Gly Thr Leu Leu Val			
325	330	335	
Asn Asp Val Leu Ala Ser Cys Tyr Ala Val Leu Glu Ser His Gln Trp			
340	345	350	
Ala His Arg Ala Phe Ala Pro Leu Arg Leu Leu His Ala Leu Gly Ala			
355	360	365	
Leu Leu Pro Gly Gly Ala Val Gln Pro Thr Gly Met His Trp Tyr Ser			

370

375

380

Arg Leu Leu Tyr Arg Leu Ala Glu Glu Leu Met Gly
385 390 395

<210> 12

<211> 411

<212> PRT

<213> mouse Ihh

<400> 12

Met Ser Pro Ala Trp Leu Arg Pro Arg Leu Arg Phe Cys Leu Phe Leu
1 5 10 15

Leu Leu Leu Leu Val Pro Ala Ala Arg Gly Cys Gly Pro Gly Arg
20 25 30

Val Val Gly Ser Arg Arg Arg Pro Pro Arg Lys Leu Val Pro Leu Ala
35 40 45

Tyr Lys Gln Phe Ser Pro Asn Val Pro Glu Lys Thr Leu Gly Ala Ser
50 55 60

Gly Arg Tyr Glu Gly Lys Ile Ala Arg Ser Ser Glu Arg Phe Lys Glu
65 70 75 80

Leu Thr Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn
85 90 95

Thr Gly Ala Asp Arg Leu Met Thr Gln Arg Cys Lys Asp Arg Leu Asn
100 105 110

Ser Leu Ala Ile Ser Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg
115 120 125

Val Thr Glu Gly Arg Asp Glu Asp Gly His His Ser Glu Glu Ser Leu
130 135 140

His Tyr Glu Gly Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg
145 150 155 160

Asn Lys Tyr Gly Leu Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp
165 170 175

Trp Val Tyr Tyr Glu Ser Lys Ala His Val His Cys Ser Val Lys Ser
180 185 190

Glu His Ser Ala Ala Lys Thr Gly Gly Cys Phe Pro Ala Gly Ala
195 200 205

Gln Val Arg Leu Glu Asn Gly Glu Arg Val Ala Leu Ser Ala Val Lys
210 215 220

Pro Gly Asp Arg Val Leu Ala Met Gly Glu Asp Gly Thr Pro Thr Phe
225 230 235 240

Ser Asp Val Leu Ile Phe Leu Asp Arg Glu Pro Asn Arg Leu Arg Ala

245	250	255				
Phe Gln Val Ile Glu Thr Gln Asp Pro Pro Arg Arg Leu Ala Leu Thr 260	265	270				
Pro Ala His Leu Leu Phe Ile Ala Asp Asn His Thr Glu Pro Ala Ala 275	280	285				
His Phe Arg Ala Thr Phe Ala Ser His Val Gln Pro Gly Gln Tyr Val 290	295	300				
Leu Val Ser Gly Val Pro Gly Leu Gln Pro Ala Arg Val Ala Ala Val 305	310	315	320			
Ser Thr His Val Ala Leu Gly Ser Tyr Ala Pro Leu Thr Arg His Gly 325	330	335				
Thr Leu Val Val Glu Asp Val Val Ala Ser Cys Phe Ala Ala Val Ala 340	345	350				
Asp His His Leu Ala Gln Leu Ala Phe Trp Pro Leu Arg Leu Phe Pro 355	360	365				
Ser Leu Ala Trp Gly Ser Trp Thr Pro Ser Glu Gly Val His Ser Tyr 370	375	380				
Pro Gln Met Leu Tyr Arg Leu Gly Arg Leu Leu Leu Glu Glu Ser Thr 385	390	395	400			
Phe His Pro Leu Gly Met Ser Gly Ala Gly Ser 405	410					
<210> 13						
<211> 437						
<212> PRT						
<213> mouse Shh						
<400> 13						
Met Leu Leu Leu Leu Ala Arg Cys Phe Leu Val Ile Leu Ala Ser Ser 1				5	10	15
Leu Leu Val Cys Pro Gly Leu Ala Cys Gly Pro Gly Arg Gly Phe Gly 20				25	30	
Lys Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys Gln Phe 35				40	45	
Ile Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg Tyr Glu 50				55	60	
Gly Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr Pro Asn 65				70	75	80
Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly Ala Asp 85				90	95	
Arg Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ala Leu Ala Ile						

100 105 110

Ser Val Met Asn Gln Trp Pro Gly Val Arg Leu Arg Val Thr Glu Gly
115 120 125

Trp Asp Glu Asp Gly His His Ser Glu Glu Ser Leu His Tyr Glu Gly
130 135 140

Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg Ser Lys Tyr Gly
145 150 155 160

Met Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr
165 170 175

Glu Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn Ser Val
180 185 190

Ala Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Ala Thr Val His Leu
195 200 205

Glu Gln Gly Gly Thr Lys Leu Val Lys Asp Leu Arg Pro Gly Asp Arg
210 215 220

Val Leu Ala Ala Asp Asp Gln Gly Arg Leu Leu Tyr Ser Asp Phe Leu
225 230 235 240

Thr Phe Leu Asp Arg Asp Glu Gly Ala Lys Lys Val Phe Tyr Val Ile
245 250 255

Glu Thr Leu Glu Pro Arg Glu Arg Leu Leu Leu Thr Ala Ala His Leu
260 265 270

Leu Phe Val Ala Pro His Asn Asp Ser Gly Pro Thr Pro Gly Pro Ser
275 280 285

Ala Leu Phe Ala Ser Arg Val Arg Pro Gly Gln Arg Val Tyr Val Val
290 295 300

Ala Glu Arg Gly Gly Asp Arg Arg Leu Leu Pro Ala Ala Val His Ser
305 310 315 320

Val Thr Leu Arg Glu Glu Ala Gly Ala Tyr Ala Pro Leu Thr Ala
325 330 335

His Gly Thr Ile Leu Ile Asn Arg Val Leu Ala Ser Cys Tyr Ala Val
340 345 350

Ile Glu Glu His Ser Trp Ala His Arg Ala Phe Ala Pro Phe Arg Leu
355 360 365

Ala His Ala Leu Leu Ala Ala Leu Ala Pro Ala Arg Thr Asp Gly Gly
370 375 380

Gly Gly Gly Ser Ile Pro Ala Ala Gln Ser Ala Thr Glu Ala Arg Gly
385 390 395 400

Ala Glu Pro Thr Ala Gly Ile His Trp Tyr Ser Gln Leu Leu Tyr His

405 410 415

Ile Gly Thr Trp Leu Leu Asp Ser Glu Thr Met His Pro Leu Gly Met
420 425 430

Ala Val Lys Ser Ser
435

<210> 14
<211> 418
<212> PRT
<213> zebrafish Shh

<400> 14
Met Arg Leu Leu Thr Arg Val Leu Leu Val Ser Leu Leu Thr Leu Ser
1 5 10 15

Leu Val Val Ser Gly Leu Ala Cys Gly Pro Gly Arg Gly Tyr Gly Arg
20 25 30

Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys Gln Phe Ile
35 40 45

Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg Tyr Glu Gly
50 55 60

Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr Pro Asn Tyr
65 70 75 80

Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly Ala Asp Arg
85 90 95

Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ser Leu Ala Ile Ser
100 105 110

Val Met Asn His Trp Pro Gly Val Lys Leu Arg Val Thr Glu Gly Trp
115 120 125

Asp Glu Asp Gly His His Phe Glu Glu Ser Leu His Tyr Glu Gly Arg
130 135 140

Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Lys Ser Lys Tyr Gly Thr
145 150 155 160

Leu Ser Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr Glu
165 170 175

Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn Ser Val Ala
180 185 190

Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Ala Leu Val Ser Leu Gln
195 200 205

Asp Gly Gly Gln Lys Ala Val Lys Asp Leu Asn Pro Gly Asp Lys Val
210 215 220

Leu Ala Ala Asp Ser Ala Gly Asn Leu Val Phe Ser Asp Phe Ile Met

225 230 235 240
Phe Thr Asp Arg Asp Ser Thr Thr Arg Arg Val Phe Tyr Val Ile Glu
245 250 255
Thr Gln Glu Pro Val Glu Lys Ile Thr Leu Thr Ala Ala His Leu Leu
260 265 270
Phe Val Leu Asp Asn Ser Thr Glu Asp Leu His Thr Met Thr Ala Ala
275 280 285
Tyr Ala Ser Ser Val Arg Ala Gly Gln Lys Val Met Val Val Asp Asp
290 295 300
Ser Gly Gln Leu Lys Ser Val Ile Val Gln Arg Ile Tyr Thr Glu Glu
305 310 315 320
Gln Arg Gly Ser Phe Ala Pro Val Thr Ala His Gly Thr Ile Val Val
325 330 335
Asp Arg Ile Leu Ala Ser Cys Tyr Ala Val Ile Glu Asp Gln Gly Leu
340 345 350
Ala His Leu Ala Phe Ala Pro Ala Arg Leu Tyr Tyr Tyr Val Ser Ser
355 360 365
Phe Leu Ser Pro Lys Thr Pro Ala Val Gly Pro Met Arg Leu Tyr Asn
370 375 380
Arg Arg Gly Ser Thr Gly Thr Pro Gly Ser Cys His Gln Met Gly Thr
385 390 395 400
Trp Leu Leu Asp Ser Asn Met Leu His Pro Leu Gly Met Ser Val Asn
405 410 415
Ser Ser

<210> 15
<211> 475
<212> PRT
<213> human Shh

<220>
<223> Xaa at position 463 is any or unknown amino acid

<400> 15
Met Leu Leu Leu Ala Arg Cys Leu Leu Leu Val Leu Val Ser Ser Leu
1 5 10 15
Leu Val Cys Ser Gly Leu Ala Cys Gly Pro Gly Arg Gly Phe Gly Lys
20 25 30
Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys Gln Phe Ile
35 40 45
Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg Tyr Glu Gly
50 55 60

Lys Ile Ser Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr Pro Asn Tyr
65 70 75 80

Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly Ala Asp Arg
85 90 95

Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ala Leu Ala Ile Ser
100 105 110

Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg Val Thr Glu Gly Trp
115 120 125

Asp Glu Asp Gly His His Ser Glu Glu Ser Leu His Tyr Glu Gly Arg
130 135 140

Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg Ser Lys Tyr Gly Met
145 150 155 160

Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr Glu
165 170 175

Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn Ser Val Ala
180 185 190

Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Ala Thr Val His Leu Glu
195 200 205

Gln Gly Gly Thr Lys Leu Val Lys Asp Leu Ser Pro Gly Asp Arg Val
210 215 220

Leu Ala Ala Asp Asp Gln Gly Arg Leu Leu Tyr Ser Asp Phe Leu Thr
225 230 235 240

Phe Leu Asp Arg Asp Asp Gly Ala Lys Lys Val Phe Tyr Val Ile Glu
245 250 255

Thr Arg Glu Pro Arg Glu Arg Leu Leu Thr Ala Ala His Leu Leu
260 265 270

Phe Val Ala Pro His Asn Asp Ser Ala Thr Gly Glu Pro Glu Ala Ser
275 280 285

Ser Gly Ser Gly Pro Pro Ser Gly Gly Ala Leu Gly Pro Arg Ala Leu
290 295 300

Phe Ala Ser Arg Val Arg Pro Gly Gln Arg Val Tyr Val Val Ala Glu
305 310 315 320

Arg Asp Gly Asp Arg Arg Leu Leu Pro Ala Ala Val His Ser Val Thr
325 330 335

Leu Ser Glu Glu Ala Ala Gly Ala Tyr Ala Pro Leu Thr Ala Gln Gly
340 345 350

Thr Ile Leu Ile Asn Arg Val Leu Ala Ser Cys Tyr Ala Val Ile Glu
355 360 365

Glu His Ser Trp Ala His Arg Ala Phe Ala Pro Phe Arg Leu Ala His
370 375 380

Ala Leu Leu Ala Ala Leu Ala Pro Ala Arg Thr Asp Arg Gly Gly Asp
385 390 395 400

Ser Gly Gly Asp Arg Gly Gly Gly Gly Arg Val Ala Leu Thr
405 410 415

Ala Pro Gly Ala Ala Asp Ala Pro Gly Ala Gly Ala Thr Ala Gly Ile
420 425 430

His Trp Tyr Ser Gln Leu Leu Tyr Gln Ile Gly Thr Trp Leu Leu Asp
435 440 445

Ser Glu Ala Leu His Pro Leu Gly Met Ala Val Lys Ser Ser Xaa Ser
450 455 460

Arg Gly Ala Gly Gly Ala Arg Glu Gly Ala
465 470 475

<210> 16
<211> 411
<212> PRT
<213> human Ihh

<400> 16

Met Ser Pro Ala Arg Leu Arg Pro Arg Leu His Phe Cys Leu Val Leu
1 5 10 15

Leu Leu Leu Leu Val Val Pro Ala Ala Trp Gly Cys Gly Pro Gly Arg
20 25 30

Val Val Gly Ser Arg Arg Arg Pro Pro Arg Lys Leu Val Pro Leu Ala
35 40 45

Tyr Lys Gln Phe Ser Pro Asn Val Pro Glu Lys Thr Leu Gly Ala Ser
50 55 60

Gly Arg Tyr Glu Gly Lys Ile Ala Arg Ser Ser Glu Arg Phe Lys Glu
65 70 75 80

Leu Thr Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn
85 90 95

Thr Gly Ala Asp Arg Leu Met Thr Gln Arg Cys Lys Asp Arg Leu Asn
100 105 110

Ser Leu Ala Ile Ser Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg
115 120 125

Val Thr Glu Gly Trp Asp Glu Asp Gly His His Ser Glu Glu Ser Leu
130 135 140

His Tyr Glu Gly Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg
145 150 155 160

Asn Lys Tyr Gly Leu Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp
165 170 175

Trp Val Tyr Tyr Glu Ser Lys Ala His Val His Cys Ser Val Lys Ser
180 185 190

Glu His Ser Ala Ala Ala Lys Thr Gly Gly Cys Phe Pro Ala Gly Ala
195 200 205

Gln Val Arg Leu Glu Ser Gly Ala Arg Val Ala Leu Ser Ala Val Arg
210 215 220

Pro Gly Asp Arg Val Leu Ala Met Gly Glu Asp Gly Ser Pro Thr Phe
225 230 235 240

Ser Asp Val Leu Ile Phe Leu Asp Arg Glu Pro His Arg Leu Arg Ala
245 250 255

Phe Gln Val Ile Glu Thr Gln Asp Pro Pro Arg Arg Leu Ala Leu Thr
260 265 270

Pro Ala His Leu Leu Phe Thr Ala Asp Asn His Thr Glu Pro Ala Ala
275 280 285

Arg Phe Arg Ala Thr Phe Ala Ser His Val Gln Pro Gly Gln Tyr Val
290 295 300

Leu Val Ala Gly Val Pro Gly Leu Gln Pro Ala Arg Val Ala Ala Val
305 310 315 320

Ser Thr His Val Ala Leu Gly Ala Tyr Ala Pro Leu Thr Lys His Gly
325 330 335

Thr Leu Val Val Glu Asp Val Val Ala Ser Cys Phe Ala Ala Val Ala
340 345 350

Asp His His Leu Ala Gln Leu Ala Phe Trp Pro Leu Arg Leu Phe His
355 360 365

Ser Leu Ala Trp Gly Ser Trp Thr Pro Gly Glu Gly Val His Trp Tyr
370 375 380

Pro Gln Leu Leu Tyr Arg Leu Gly Arg Leu Leu Leu Glu Glu Gly Ser
385 390 395 400

Phe His Pro Leu Gly Met Ser Gly Ala Gly Ser
405 410

<210> 17
<211> 396
<212> PRT
<213> human Dhh

<400> 17
Met Ala Leu Leu Thr Asn Leu Leu Pro Leu Cys Cys Leu Ala Leu Leu
1 5 10 15

Ala Leu Pro Ala Gln Ser Cys Gly Pro Gly Arg Gly Pro Val Gly Arg
20 25 30

Arg Arg Tyr Ala Arg Lys Gln Leu Val Pro Leu Leu Tyr Lys Gln Phe
35 40 45

Val Pro Gly Val Pro Glu Arg Thr Leu Gly Ala Ser Gly Pro Ala Glu
50 55 60

Gly Arg Val Ala Arg Gly Ser Glu Arg Phe Arg Asp Leu Val Pro Asn
65 70 75 80

Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Ser Gly Ala Asp
85 90 95

Arg Leu Met Thr Glu Arg Cys Lys Glu Arg Val Asn Ala Leu Ala Ile
100 105 110

Ala Val Met Asn Met Trp Pro Gly Val Arg Leu Arg Val Thr Glu Gly
115 120 125

Trp Asp Glu Asp Gly His His Ala Gln Asp Ser Leu His Tyr Glu Gly
130 135 140

Arg Ala Leu Asp Ile Thr Thr Ser Asp Arg Asp Arg Asn Lys Tyr Gly
145 150 155 160

Leu Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr
165 170 175

Glu Ser Arg Asn His Val His Val Ser Val Lys Ala Asp Asn Ser Leu
180 185 190

Ala Val Arg Ala Gly Gly Cys Phe Pro Gly Asn Ala Thr Val Arg Leu
195 200 205

Trp Ser Gly Glu Arg Lys Gly Leu Arg Glu Leu His Arg Gly Asp Trp
210 215 220

Val Leu Ala Ala Asp Ala Ser Gly Arg Val Val Pro Thr Pro Val Leu
225 230 235 240

Leu Phe Leu Asp Arg Asp Leu Gln Arg Arg Ala Ser Phe Val Ala Val
245 250 255

Glu Thr Glu Trp Pro Pro Arg Lys Leu Leu Leu Thr Pro Trp His Leu
260 265 270

Val Phe Ala Ala Arg Gly Pro Ala Pro Ala Pro Gly Asp Phe Ala Pro
275 280 285

Val Phe Ala Arg Arg Leu Arg Ala Gly Asp Ser Val Leu Ala Pro Gly
290 295 300

Gly Asp Ala Leu Arg Pro Ala Arg Val Ala Arg Val Ala Arg Glu Glu
305 310 315 320

Ala Val Gly Val Phe Ala Pro Leu Thr Ala His Gly Thr Leu Leu Val
325 330 335

Asn Asp Val Leu Ala Ser Cys Tyr Ala Val Leu Glu Ser His Gln Trp
340 345 350

Ala His Arg Ala Phe Ala Pro Leu Arg Leu Leu His Ala Leu Gly Ala
355 360 365

Leu Leu Pro Gly Gly Ala Val Gln Pro Thr Gly Met His Trp Tyr Ser
370 375 380

Arg Leu Leu Tyr Arg Leu Ala Glu Glu Leu Leu Gly
385 390 395

<210> 18
<211> 416
<212> PRT
<213> Zebrafish Thh

<400> 18
Met Asp Val Arg Leu His Leu Lys Gln Phe Ala Leu Leu Cys Phe Ile
1 5 10 15

Ser Leu Leu Leu Thr Pro Cys Gly Leu Ala Cys Gly Pro Gly Arg Gly
20 25 30

Tyr Gly Lys Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys
35 40 45

Gln Phe Ile Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Lys
50 55 60

Tyr Glu Gly Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Ile
65 70 75 80

Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Asn
85 90 95

Ala Asp Arg Leu Met Thr Lys Arg Cys Lys Asp Lys Leu Asn Ser Leu
100 105 110

Ala Ile Ser Val Met Asn His Trp Pro Gly Val Lys Leu Arg Val Thr
115 120 125

Glu Gly Trp Asp Glu Asp Gly His His Leu Glu Glu Ser Leu His Tyr
130 135 140

Glu Gly Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Lys Ser Lys
145 150 155 160

Tyr Gly Met Leu Ser Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val
165 170 175

Tyr Tyr Glu Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn
180 185 190

Ser Val Ala Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Gly Thr Val
 195 200 205
 Thr Leu Gly Asp Gly Thr Arg Lys Pro Ile Lys Asp Leu Lys Val Gly
 210 215 220
 Asp Arg Val Leu Ala Ala Asp Glu Lys Gly Asn Val Leu Ile Ser Asp
 225 230 235 240
 Phe Ile Met Phe Ile Asp His Asp Pro Thr Thr Arg Arg Gln Phe Ile
 245 250 255
 Val Ile Glu Thr Ser Glu Pro Phe Thr Lys Leu Thr Leu Thr Ala Ala
 260 265 270
 His Leu Val Phe Val Gly Asn Ser Ser Ala Ala Ser Gly Ile Thr Ala
 275 280 285
 Thr Phe Ala Ser Asn Val Lys Pro Gly Asp Thr Val Leu Val Trp Glu
 290 295 300
 Asp Thr Cys Glu Ser Leu Lys Ser Val Thr Val Lys Arg Ile Tyr Thr
 305 310 315 320
 Glu Glu His Glu Gly Ser Phe Ala Pro Val Thr Ala His Gly Thr Ile
 325 330 335
 Ile Val Asp Gln Val Leu Ala Ser Cys Tyr Ala Val Ile Glu Asn His
 340 345 350
 Lys Trp Ala His Trp Ala Phe Ala Pro Val Arg Leu Cys His Lys Leu
 355 360 365
 Met Thr Trp Leu Phe Pro Ala Arg Glu Ser Asn Val Asn Phe Gln Glu
 370 375 380
 Asp Gly Ile His Trp Tyr Ser Asn Met Leu Phe His Ile Gly Ser Trp
 385 390 395 400
 Leu Leu Asp Arg Asp Ser Phe His Pro Leu Gly Ile Leu His Leu Ser
 405 410 415

<210> 19
 <211> 1416
 <212> DNA
 <213> Drosophila HH

<220>
 <221> CDS
 <222> (1)..(1413)

<400> 19
 atg gat aac cac agc tca gtg cct tgg gcc agt gcc gcc agt gtc acc
 Met Asp Asn His Ser Ser Val Pro Trp Ala Ser Ala Ala Ser Val Thr
 1 5 10 15

tgt ctc tcc ctg gga tgc caa atg cca cag ttc cag ttc cag			96
Cys Leu Ser Leu Gly Cys Gln Met Pro Gln Phe Gln Phe Gln			
20	25	30	
ctc caa atc cgc agc gag ctc cat ctc cgc aag ccc gca aga aga acg			144
Leu Gln Ile Arg Ser Glu Leu His Leu Arg Lys Pro Ala Arg Arg Thr			
35	40	45	
caa acg atg cgc cac att gcg cat acg cag cgt tgc ctc agc agg ctg			192
Gln Thr Met Arg His Ile Ala His Thr Gln Arg Cys Leu Ser Arg Leu			
50	55	60	
acc tct ctg gtg gcc ctg ctg atc gtc ttg ccg atg gtc ttt agc			240
Thr Ser Leu Val Ala Leu Leu Ile Val Leu Pro Met Val Phe Ser			
65	70	75	80
ccg gct cac agc tgc ggt cct ggc cga gga ttg ggt cgt cat agg gcg			288
Pro Ala His Ser Cys Gly Pro Gly Arg Gly Leu Gly Arg His Arg Ala			
85	90	95	
cgc aac ctg tat ccg ctg gtc ctc aag cag aca att ccc aat cta tcc			336
Arg Asn Leu Tyr Pro Leu Val Leu Lys Gln Thr Ile Pro Asn Leu Ser			
100	105	110	
gag tac acg aac agc gcc tcc gga cct ctg gag ggt gtg atc cgt cgg			384
Glu Tyr Thr Asn Ser Ala Ser Gly Pro Leu Glu Gly Val Ile Arg Arg			
115	120	125	
gat tcg ccc aaa ttc aag gac ctc gtg ccc aac tac aac agg gac atc			432
Asp Ser Pro Lys Phe Lys Asp Leu Val Pro Asn Tyr Asn Arg Asp Ile			
130	135	140	
ctt ttc cgt gac gag gaa ggc acc gga gcg gat ggc ttg atg agc aag			480
Leu Phe Arg Asp Glu Glu Gly Thr Gly Ala Asp Gly Leu Met Ser Lys			
145	150	155	160
cgc tgc aag gag aag cta aac gtg ctg gcc tac tcg gtg atg aac gaa			528
Arg Cys Lys Glu Lys Leu Asn Val Leu Ala Tyr Ser Val Met Asn Glu			
165	170	175	
tgg ccc ggc atc cgg ctg gtc acc gag agc tgg gac gag gac tac			576
Trp Pro Gly Ile Arg Leu Leu Val Thr Glu Ser Trp Asp Glu Asp Tyr			
180	185	190	
cat cac ggc cag gag tcg ctc cac tac gag ggc cga gcg gtg acc att			624
His His Gly Gln Glu Ser Leu His Tyr Glu Gly Arg Ala Val Thr Ile			
195	200	205	
gcc acc tcc gat cgc gac cag tcc aaa tac ggc atg ctc gct cgc ctg			672
Ala Thr Ser Asp Arg Asp Gln Ser Lys Tyr Gly Met Leu Ala Arg Leu			
210	215	220	
gcc gtc gag gct gga ttc gat tgg gtc tcc tac gtc agc agg cgc cac			720
Ala Val Glu Ala Gly Phe Asp Trp Val Ser Tyr Val Ser Arg Arg His			
225	230	235	240

atc tac tgc tcc gtc aag tca gat tcg tcg atc agt tcc cac gtg cac Ile Tyr Cys Ser Val Lys Ser Asp Ser Ser Ile Ser Ser His Val His 245 250 255	768
ggc tgc ttc acg ccg gag agc aca gcg ctg ctg gag agt gga gtc cg Gly Cys Phe Thr Pro Glu Ser Thr Ala Leu Leu Glu Ser Gly Val Arg 260 265 270	816
aag ccg ctc ggc gag ctc tct atc gga gat cgt gtt ttg agc atg acc Lys Pro Leu Gly Glu Leu Ser Ile Gly Asp Arg Val Leu Ser Met Thr 275 280 285	864
gcc aac gga cag gcc gtc tac agc gaa gtg atc ctc ttc atg gac cgc Ala Asn Gly Gln Ala Val Tyr Ser Glu Val Ile Leu Phe Met Asp Arg 290 295 300	912
aac ctc gag cag atg caa aac ttt gtg cag ctg cac acg gac ggt gga Asn Leu Glu Gln Met Gln Asn Phe Val Gln Leu His Thr Asp Gly Gly 305 310 315 320	960
gca gtg ctc acg gtg acg ccg gct cac ctg gtt agc gtt tgg cag ccg Ala Val Leu Thr Val Thr Pro Ala His Leu Val Ser Val Trp Gln Pro 325 330 335	1008
gag agc cag aag ctc acg ttt gtg ttt gcg cat cgc atc gag gag aag Glu Ser Gln Lys Leu Thr Phe Val Ala His Arg Ile Glu Glu Lys 340 345 350	1056
aac cag gtg ctc gta cgg gat gtg gag acg ggc gag ctg agg ccc cag Asn Gln Val Leu Val Arg Asp Val Glu Thr Gly Glu Leu Arg Pro Gln 355 360 365	1104
cga gtg gtc aag ttg ggc agt gtg cgc agt aag ggc gtg gtc gcg ccg Arg Val Val Lys Leu Gly Ser Val Arg Ser Lys Gly Val Val Ala Pro 370 375 380	1152
ctg acc cgc gag ggc acc att gtg gtc aac tcg gtg gcc gcc agt tgc Leu Thr Arg Glu Gly Thr Ile Val Val Asn Ser Val Ala Ala Ser Cys 385 390 395 400	1200
tat gcg gtg atc aac agt cag tcg ctg gcc cac tgg gga ctg gct ccc Tyr Ala Val Ile Asn Ser Gln Ser Leu Ala His Trp Gly Leu Ala Pro 405 410 415	1248
atg cgc ctg ctg tcc acg ctg gag gcg tgg ctg ccc gcc aag gag cag Met Arg Leu Leu Ser Thr Leu Glu Ala Trp Leu Pro Ala Lys Glu Gln 420 425 430	1296
ttg cac agt tcg ccg aag gtg gtg agc tcg gcg cag cag cag aat ggc Leu His Ser Ser Pro Lys Val Val Ser Ser Ala Gln Gln Gln Asn Gly 435 440 445	1344
atc cat tgg tat gcc aat gcg ctc tac aag gtc aag gac tac gtg ctg Ile His Trp Tyr Ala Asn Ala Leu Tyr Lys Val Lys Asp Tyr Val Leu 450 455 460	1392
ccg cag agc tgg cgc cac gat tga	1416

Pro Gln Ser Trp Arg His Asp
465 470

<210> 20
<211> 471
<212> PRT
<213> Drosophila HH

<400> 20
Met Asp Asn His Ser Ser Val Pro Trp Ala Ser Ala Ala Ser Val Thr
1 5 10 15

Cys Leu Ser Leu Gly Cys Gln Met Pro Gln Phe Gln Phe Gln Phe Gln
20 25 30

Leu Gln Ile Arg Ser Glu Leu His Leu Arg Lys Pro Ala Arg Arg Thr
35 40 45

Gln Thr Met Arg His Ile Ala His Thr Gln Arg Cys Leu Ser Arg Leu
50 55 60

Thr Ser Leu Val Ala Leu Leu Ile Val Leu Pro Met Val Phe Ser
65 70 75 80

Pro Ala His Ser Cys Gly Pro Gly Arg Gly Leu Gly Arg His Arg Ala
85 90 95

Arg Asn Leu Tyr Pro Leu Val Leu Lys Gln Thr Ile Pro Asn Leu Ser
100 105 110

Glu Tyr Thr Asn Ser Ala Ser Gly Pro Leu Glu Gly Val Ile Arg Arg
115 120 125

Asp Ser Pro Lys Phe Lys Asp Leu Val Pro Asn Tyr Asn Arg Asp Ile
130 135 140

Leu Phe Arg Asp Glu Glu Gly Thr Gly Ala Asp Gly Leu Met Ser Lys
145 150 155 160

Arg Cys Lys Glu Lys Leu Asn Val Leu Ala Tyr Ser Val Met Asn Glu
165 170 175

Trp Pro Gly Ile Arg Leu Leu Val Thr Glu Ser Trp Asp Glu Asp Tyr
180 185 190

His His Gly Gln Glu Ser Leu His Tyr Glu Gly Arg Ala Val Thr Ile
195 200 205

Ala Thr Ser Asp Arg Asp Gln Ser Lys Tyr Gly Met Leu Ala Arg Leu
210 215 220

Ala Val Glu Ala Gly Phe Asp Trp Val Ser Tyr Val Ser Arg Arg His
225 230 235 240

Ile Tyr Cys Ser Val Lys Ser Asp Ser Ser Ile Ser Ser His Val His
245 250 255

Gly Cys Phe Thr Pro Glu Ser Thr Ala Leu Leu Glu Ser Gly Val Arg
260 265 270

Lys Pro Leu Gly Glu Leu Ser Ile Gly Asp Arg Val Leu Ser Met Thr
275 280 285

Ala Asn Gly Gln Ala Val Tyr Ser Glu Val Ile Leu Phe Met Asp Arg
290 295 300

Asn Leu Glu Gln Met Gln Asn Phe Val Gln Leu His Thr Asp Gly Gly
305 310 315 320

Ala Val Leu Thr Val Thr Pro Ala His Leu Val Ser Val Trp Gln Pro
325 330 335

Glu Ser Gln Lys Leu Thr Phe Val Phe Ala His Arg Ile Glu Glu Lys
340 345 350

Asn Gln Val Leu Val Arg Asp Val Glu Thr Gly Glu Leu Arg Pro Gln
355 360 365

Arg Val Val Lys Leu Gly Ser Val Arg Ser Lys Gly Val Val Ala Pro
370 375 380

Leu Thr Arg Glu Gly Thr Ile Val Val Asn Ser Val Ala Ala Ser Cys
385 390 395 400

Tyr Ala Val Ile Asn Ser Gln Ser Leu Ala His Trp Gly Leu Ala Pro
405 410 415

Met Arg Leu Leu Ser Thr Leu Glu Ala Trp Leu Pro Ala Lys Glu Gln
420 425 430

Leu His Ser Ser Pro Lys Val Val Ser Ser Ala Gln Gln Gln Asn Gly
435 440 445

Ile His Trp Tyr Ala Asn Ala Leu Tyr Lys Val Lys Asp Tyr Val Leu
450 455 460

Pro Gln Ser Trp Arg His Asp
465 470

<210> 21
<211> 221
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: degenerate
polypeptide sequence

<220>
<221> SITE
<222> 7
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Phe, Tyr or Trp

<220>
<221> SITE
<222> 9
<223> Xaa represents Arg, His or Lys

<220>
<221> SITE
<222> 44
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<221> SITE
<222> 85
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<221> SITE
<222> 93
<223> Xaa represents Lys, Arg, His, Asn or Gln

<220>
<221> SITE
<222> 98
<223> Xaa represents Lys, Arg or His

<220>
<221> SITE
<222> 112
<223> Xaa represents Ser, Thr, Tyr, Trp or Phe

<220>
<221> SITE
<222> 132
<223> Xaa represents Lys, Arg or His

<220>
<221> SITE
<222> 137
<223> Xaa represents Met, Cys, Ser or Thr

<220>
<221> SITE
<222> 139
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<221> SITE
<222> 181
<223> Xaa represents Leu, Val, Met, Thr or Ser

<220>
<221> SITE
<222> 183
<223> Xaa represents His, Phe, Tyr, Ser, Thr, Met or Cys

<220>

<221> SITE
<222> 185
<223> Xaa represents Gln, Asn, Glu, or Asp

<220>
<221> SITE
<222> 186
<223> Xaa represents His, Phe, Tyr, Thr, Gln, Asn, Glu or Asp

<220>
<221> SITE
<222> 189
<223> Xaa represents Gln, Asn, Glu, Asp, Thr, Ser, Met or Cys

<220>
<221> SITE
<222> 191
<223> Xaa represents Ala, Gly, Cys, Leu, Val or Met

<220>
<221> SITE
<222> 196
<223> Xaa represents Arg, Lys, Met, Ile, Asn, Asp, Glu, Gln, Ser, Thr or Cys

<220>
<221> SITE
<222> 200
<223> Xaa represents Arg, Lys, Met or Ile

<220>
<221> SITE
<222> 206
<223> Xaa represents Ala, Gly, Cys, Asp, Glu, Gln, Asn, Ser, Thr or Met

<220>
<221> SITE
<222> 207
<223> Xaa represents Ala, Gly, Cys, Asp, Asn, Glu or Gln

<220>
<221> SITE
<222> 209
<223> Xaa represents Arg, Lys, Met, Ile, Asn, Asp, Glu or Gln

<220>
<221> SITE
<222> 211
<223> Xaa represents Leu, Val, Met or Ile

<220>
<221> SITE
<222> 212
<223> Xaa represents Phe, Tyr, Thr, His or Trp

<220>
<221> SITE

<210> 22
<211> 167
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: degenerate polypeptide sequence

<220>
<221> SITE
<222> 7
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Pro, Phe or Tyr

<220>
<221> SITE
<222> 8
<223> Xaa represents Gly, Ala, Val, Leu or Ile

<220>
<221> SITE
<222> 9
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Lys, His or Arg

<220>
<221> SITE
<222> 12
<223> Xaa represents Lys, Arg or His

<220>
<221> SITE
<222> 13
<223> Xaa represents Phe, Trp, Tyr or an amino acid gap

<220>
<221> SITE
<222> 14
<223> Xaa represents Gly, Ala, Val, Leu, Ile or an amino acid gap

<220>
<221> SITE
<222> 17
<223> Xaa represents Asn, Gln, His, Arg or Lys

<220>
<221> SITE
<222> 19
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<221> SITE
<222> 22
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>

<221> SITE
<222> 27
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<221> SITE
<222> 29
<223> Xaa represents Ser, Thr, Gln or Asn

<220>
<221> SITE
<222> 30
<223> Xaa represents Met, Cys, Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<221> SITE
<222> 31
<223> Xaa represents Gly, Ala, Val, Leu, Ile or Pro

<220>
<221> SITE
<222> 33
<223> Xaa represents Arg, His or Lys

<220>
<221> SITE
<222> 40
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Pro, Arg, His or Lys

<220>
<221> SITE
<222> 41
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Phe or Tyr

<220>
<221> SITE
<222> 44
<223> Xaa represents Arg, His or Lys

<220>
<221> SITE
<222> 45
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<221> SITE
<222> 46
<223> Xaa represents Thr or Ser

<220>
<221> SITE
<222> 48
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Asn or Gln

<220>
<221> SITE
<222> 53

<223> Xaa represents Arg, His or Lys

<220>

<221> SITE

<222> 54

<223> Xaa represents Asp or Glu

<220>

<221> SITE

<222> 71

<223> Xaa represents Ser or Thr

<220>

<221> SITE

<222> 79

<223> Xaa represents Glu, Asp, Gln or Asn

<220>

<221> SITE

<222> 83

<223> Xaa represents Glu or Asp;

<220>

<221> SITE

<222> 84

<223> Xaa represents Arg, His or Lys

<220>

<221> SITE

<222> 85

<223> Xaa represents Gly, Ala, Val, Leu or Ile

<220>

<221> SITE

<222> 87

<223> Xaa represents Gly, Ala, Val, Leu, Ile, Thr or Ser

<220>

<221> SITE

<222> 95

<223> Xaa represents Met, Cys, Gln, Asn, Arg, Lys or His

<220>

<221> SITE

<222> 100

<223> Xaa represents Arg, His or Lys

<220>

<221> SITE

<222> 107

<223> Xaa represents Trp, Phe, Tyr, Arg, His or Lys

<220>

<221> SITE

<222> 114

<223> Xaa represents Gly, Ala, Val, Leu, Ile, Ser, Thr, Tyr or Phe

<220>
<221> SITE
<222> 115
<223> Xaa represents Gln, Asn, Asp or Glu

<220>
<221> SITE
<222> 116
<223> Xaa represents Asp or Glu;

<220>
<221> SITE
<222> 125
<223> Xaa represents Gly, Ala, Val, Leu, or Ile

<220>
<221> SITE
<222> 134
<223> Xaa represents Arg, His or Lys

<220>
<221> SITE
<222> 135
<223> Xaa represents Asn, Gln, Thr or Ser

<220>
<221> SITE
<222> 139
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Ser, Thr, Met or Cys

<220>
<221> SITE
<222> 141
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Thr or Ser

<220>
<221> SITE
<222> 157
<223> Xaa represents Arg, His or Lys

<220>
<221> SITE
<222> 158
<223> Xaa represents Asn, Gln, Gly, Ala, Val, Leu or Ile

<220>
<221> SITE
<222> 160
<223> Xaa represents Gly, Ala, Val, Leu or Ile

<220>
<221> SITE
<222> 162
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Ser, Thr or Cys

<220>
<221> SITE

<222> 166
<223> Xaa represents Gly, Ala, Val, Leu, Ile, Thr or Ser

<220>
<221> SITE
<222> 167
<223> Xaa represents Asp or Glu.

<400> 22

Cys Gly Pro Gly Arg Gly Xaa Xaa Xaa Arg Arg Xaa Xaa Xaa Pro Lys
1 5 10 15

Xaa Leu Xaa Pro Leu Xaa Tyr Lys Gln Phe Xaa Pro Xaa Xaa Xaa Glu
20 25 30

Xaa Thr Leu Gly Ala Ser Gly Xaa Xaa Glu Gly Xaa Xaa Xaa Arg Xaa
35 40 45

Ser Glu Arg Phe Xaa Xaa Leu Thr Pro Asn Tyr Asn Pro Asp Ile Ile
50 55 60

Phe Lys Asp Glu Glu Asn Xaa Gly Ala Asp Arg Leu Met Thr Xaa Arg
65 70 75 80

Cys Lys Xaa Xaa Xaa Asn Xaa Leu Ala Ile Ser Val Met Asn Xaa Trp
85 90 95

Pro Gly Val Xaa Leu Arg Val Thr Glu Gly Xaa Asp Glu Asp Gly His
100 105 110

His Xaa Xaa Xaa Ser Leu His Tyr Glu Gly Arg Ala Xaa Asp Ile Thr
115 120 125

Thr Ser Asp Arg Asp Xaa Xaa Lys Tyr Gly Xaa Leu Xaa Arg Leu Ala
130 135 140

Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr Glu Ser Xaa Xaa His Xaa
145 150 155 160

His Xaa Ser Val Lys Xaa Xaa
165

<210> 23
<211> 74
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: primer

<400> 23
gcgcgttcg aagcgaggca gccagcgagg gagagagcga gcggcgagc cggagcgagg 60
aaatcgatgc gcgc

<210> 24
<211> 74
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: primer

<400> 24
gcgcgcatat ctggaaaggc gcaagagaga ggcacacgc acacacccgc cgcgcgact 60
cgggatccgc ggcg 74

<210> 25
<211> 996
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: gene
activation construct

<400> 25
cgaagcgagg cagccagcga gggagagagc gagcgggcga gccggagcga ggaaatcgaa 60
ggttcgaatc cttccccac caccatcaact ttcaaaaagtc cgaaagaatc tgctccctgc 120
tttgtgttg gaggtcgctg agtagtgcgc gagtaaaatt taagctacaa caaggcaagg 180
cttgaccgac aattgcatga agaatctgct tagggttagg cgtttgcgc tgcttcgcga 240
tgtacgggcc agatatacgc gttgacattt attattgact agttatataat agtaatcaat 300
tacggggtca ttagttcata gcccataatat ggagttccgc gttacataac ttacggtaaa 360
tggccgcct ggctgaccgc ccaacgaccc ccgcccattt acgtcaataa tgacgtatgt 420
tccccatagta acgccaatag ggactttcca ttgacgtcaa tgggtggact atttacggta 480
aactgcccac ttggcagtac atcaagtgtt tcatatgcca agtacgcccc ctattgacgt 540
caatgacggt aaatggcccg cctggcatta tgcccagtac atgaccttat gggactttcc 600
tacttggcag tacatctacg tattagtcat cgctattacc atggatgc ggtttggca 660
gtacatcaat gggcgtggat agcggttga ctcacggggta tttccaaatc tccacccat 720
tgacgtcaat gggagttgt tttggcacca aaatcaacgg gactttccaa aatgtcgtaa 780
caactccgccc ccattgacgc aaatggccgg taggcgtgtt cgggtggagg tctatataag 840
cagagctctc tggcttaacta gagaacccac tgcttactgg cttatcgaaa ttaatacgac 900
tcactatagg gagacccaag cttggtaccg agctcgatc gatctggaa agcgcaagag 960

agagcgacaca cgcacacacc cgccgcgcg actcgg

996

<210> 26
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: antisense
construct

<400> 26
gtcctggcgc cgccgccc gtcgcc

26

CNT
B,
<210> 27
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: antisense
construct

<400> 27
ttccgatgac cggctttcg cggtga

26

<210> 28
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: antisense
construct

<400> 28
gtgcacggaa aggtgcaggc cacact

26